

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

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TO: Paul Piszczek, Fisheries Biologist, WDNR
Molly Wick, AOC Habitat Project Coordinator, WDNR
Craig Roesler, Streams Biologist, WDNR

FROM: Aaron Nelson, Fisheries Technician

SUBJECT: Fish Community Survey
Lower Nemadji River, Douglas County

**Lower Nemadji River – Douglas County
2015 Fish Community Survey Summary**



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2015
Lower Nemadji River – Douglas County
Fish Community Survey
Aaron Nelson

1. Introduction

The Nemadji River is the second largest tributary to the Duluth/Superior Harbor located at the western end of Lake Superior. The total length of the Nemadji River is 65 miles from its origin in Pine County, Minnesota to its terminus when it reaches Superior Bay in the eastern end of the Duluth/Superior Harbor. The entire Nemadji River watershed was included in the St. Louis River Area of Concern due to Beneficial Use Impairments from Excessive Loading of Sediments and Nutrients; it is also listed on the Wisconsin and Minnesota 303d Impaired Waters List for Sediment/Total Suspended Solids as a Pollutant and Degraded Habitat as an Impairment. This report will summarize survey work completed by Wisconsin DNR Fisheries Management staff to assess the fish community present in the Wisconsin portion of the Nemadji River, specifically the Lower Nemadji River watershed, from the confluence with the Black River to its terminus.

2. Site Description

The project boundary for this survey spanned from the mouth of the Nemadji River upstream to County Highway C. The current Douglas County land-use zoning along the immediate riparian area of the Nemadji River is resource conservation meaning there is no human development permitted along the banks in these zoned areas. Away from the river's edge, county land use and zoning is dominated by agricultural use with minor residential development. Within the City of Superior, the land-use and zoning along the river and within the watershed is primarily suburban or family residential with a few areas of manufacturing or industrial land-use present, most notably the Enbridge Energy refinery on the west side of the river and Burlington Northern rail yard on the east side.

The project area was measured off in one-mile segments to assign one-mile non-wadable river stations. The segment from County Highway C upstream to Finn Rd was also included to allow for additional sampling with the mini-boom if the river channel was navigable and sufficient access was available to launch the mini-boom. This segment included two previous wadable stream stations that were surveyed at Finn Road and Highway 35. Stations numbers were assigned as Station 1, at the upstream most station, continuing downstream to Station 6, the last station selected. Any stations surveyed after the original stations were designated were assigned the number of the station upstream and a letter designation; for example Station 3A was sampled after Stations 3 and 4 had been sampled.

The only sufficient access to launch the mini-boom was at Grand Avenue, and due to low water levels during the sampling period, Mile-14 was assigned Station 3 as it was the furthest upstream that navigation with the mini-boom shocker was possible. Field reconnaissance downstream from County Highway C to the Duluth, Missabe & Iron Range railroad trestle crossing revealed that in low-flow conditions the majority of the stream channel width was wadable with water depths of 1.5 feet or less, however there were deep, non-wadable pools and bends that prevented sampling with the tow barge. The prolonged low-flow conditions prior to the sampling period may have limited areas where sampling with the mini-boom could occur, however it also led to significantly improved visibility of normally very turbid water. Secchi depths taken during the sampling period ranged from 1.8 to 2.25 feet.

3. Methods

The Quality Assurance Project Plan (QAPP) developed for the Lower Nemadji River Biological and Water Quality Monitoring project mentioned use of several types of gear for sampling the fish community of the Nemadji River based on judgement of Fisheries Management staff. Ultimately, electrofishing was chosen over several types of passive net gear (fyke net, minnow trap, gill net) because electrofishing would have less selectivity by eliminating bias from chosen net locations, mesh sizes or openings on nets or traps, or fish behavior and would allow for standardized Index of Biotic Integrity sampling. Using netting gear to sample fish in the Nemadji River could be considered in the future as a means of targeting specific groups of fish or areas, but isn't an unbiased means of gauging the health of the fish community present.

Wadable Stations

The wadable station sampled at County Highway C was surveyed with a tow barge stream electrofishing unit consisting of a Whitney fiberglass sled with three anodes (see report cover). A 240-volt AC generator supplied electrical current to the cathode and anodes via a SDC rectifier control box that transformed AC current to DC. A stainless steel plate affixed to the bottom of the sled acts as the cathode and the anodes are diamond shaped stainless steel hoops epoxied into the end of a fiberglass poles; the anodes then are connected to the SDC control box with power cable by series of connectors and a retractable cable reel. Each of the anodes is deployed by personnel carrying fiberglass handle dip nets and electrofishing commenced from the station start upstream with one crew member towing the barge behind them. Fish were captured as personnel swept the anodes over or around habitat features in the stream channel; any fish captured were transferred to an aerated tub onboard the tow barge.

Water Resources has the option to use best professional judgment and sample a maximum 400-meter station if the habitat, morphology, and substrate are relatively uniform within the 35xMSW station. Based on the mean stream width of 19 meters, a station of 665 meters would have been sampled at County Highway C, however a truncated station of 400 meters was sampled at County Highway C based on available habitat types (deep meanders, shallow inside bends), substrate (sand and clay mix), and morphology (run). While sampling the additional length of the station would have yielded more fish, the extra effort typically results in catching more of the same fish species that have already been captured. Another survey of a station at State Highway 35 was scheduled to be sampled this year, but this area was last sampled in 2011 and IBI scores are considered current for 5 years from the last sampling effort. The station at County Highway C was surveyed as single run fish community (all species collected) catch-per-effort only.

Non-Wadable Stations

The non-wadable stations downstream of County Highway C were surveyed with a mini-boom shocker comprised of an outboard motor propelled aluminum johnboat with a pulsed DC electrofishing unit powered by a 3500 watt AC generator (see report cover). An anode consisting of a standard aluminum "Wisconsin ring" with 16 cylindrical, 17-mm diameter stainless steel droppers was used to deliver electrical current to the water. Pulsed DC settings were set at a pulse rate of 60-hertz and 25% duty cycle; the voltage and amperage were set to maintain electrical output to the anode as close to 3000 watts as possible. This electrofishing unit requires a two person crew consisting of a driver/operator at the stern to run the outboard, generator and electrofishing system and a "dipper" is seated at the bow of the boat with a fiberglass long-handled dip net to capture fish as they are stunned. Electrofishing commenced at the upstream end of the station and the mini-boom shocker drifted with the current or, in slower current areas, run at idle speed downstream along the bank. Fish were drawn to the anode end of the electrical field and any fish captured were transferred to an aerated stock tank on board the mini-boom. Extra sampling effort beyond a simple downstream pass was used to capture additional fish near log jams, snags, or other habitat features as they occurred in the stream channel. All of the 1-mile non-wadable stations were surveyed as single run fish community (all species collected) catch-per-effort only. The distance shocked reflects the distance the mini-boom shocker travelled along the bank and around obstacles or other structure within the 1-mile station.

Fish Processing / Data Collection

All fish captured were identified by species. Gamefish and panfish species were measured to the nearest tenth of an inch and larger individuals were weighed. All other non-gamefish species were counted. All fish captured in the survey were released back to the river with the exception of any voucher species that were retained to confirm species identification.

4. Results/Discussion

Fish Community

The Nemadji River supports a fairly diverse fish assemblage; 24 different fish species were documented in the 6 stations assessed in 2015. (Table 1, Table 3) Based on relative abundance from the electrofishing surveys, cyprinids (minnows) were the most abundant and widely distributed fish species in the Nemadji River and were represented mainly by common shiners and emerald shiners. Silver redhorse, shorthead redhorse, rock bass, smallmouth bass and walleyes were also widely distributed throughout the Nemadji River, but didn't occur in the higher abundance seen in the minnow species.

Based on the gear and sampling methodology used, the fish communities from each station were scored and rated using the Lake Superior Warmwater IBI rating to determine if the site is degraded and to what extent. The summer thermal regime of the Nemadji River is too warm to support salmonids, so based on that criteria, the Warmwater IBI was selected instead of the Coolwater IBI for wadable stations (Lyons et al., 2001). Furthermore, the thermal preferences of the species captured reflect a warmwater system. Muskellunge were the only stenothermal primary coolwater fish species captured in the 2015 surveys. The remaining species captured include a number of secondary coolwater species that occur in both coolwater and warmwater streams, but they are classified as eurythermic meaning they have no thermal requirement or preference. If more primary coolwater or primary coldwater stenothermal species were present, the case could be made for using the Coolwater IBI to determine if the Nemadji River is a degraded coolwater system.

The wadable and non-wadable Lake Superior Warmwater IBI ratings also have scoring criteria calibrated for Lake Superior basin streams that have lower sucker, darter, and centrarchid panfish species richness relative to the other basins in the state (Lyons, 1992, Lyons et al., 2001). For each respective IBI rating system, the fish community receives a score from 0 to 100 points and the score is then assigned a corresponding qualitative rating from "Very Poor" to "Excellent". There is some variation between the two different IBI rating systems for the number of points required to receive the various qualitative ratings, but generally speaking, higher IBI scores receive better qualitative ratings.

Non-Wadable Stations

The IBI scores and ratings for the non-wadable stations are not complete because weight information was not collected for all of the fish captured. Personnel on the crew were unfamiliar with the non-wadable IBI procedures and mandatory requirement for weighing all fish to compute two of the metrics. Despite missing information for two of the metrics, using the scoring metrics with the available data, the sites that were assessed scored between 56.25 and 75 points and were rated from "Fair" to "Good". These scores and ratings should be considered minimum values; if weights had been collected, it's likely all of the sites would be rated "Good", with the possibility of some sites rating "Excellent".

Fish abundance based on the catches may seem low however there are a few factors that may have influenced our ability to capture fish. The first is turbid water conditions; at its best visibility was around 2 feet, so fish had to come up into the field to be visible for dippers to capture. Another factor was the depth of the bends and pools that were sampled, some bends and pools were estimated to be up to 15 feet deep based on readings from the fish finder on board one of the boats used. Capturing fish from these deeper areas of the stream channel with the mini-boom was difficult, if not impossible. Lastly was the efficiency of the mini-boom compared to the stream shocker. The stream shocker is a more efficient

means of capturing fish because multiple anodes and dippers can be used with one electrofishing unit to cover a shallow, wadable stream channel compared to one electrofishing unit with one dipper trying to cover the immediate area along one bank of a large, non-wadable stream channel with variable water depths.

Two scoring metrics required weights and they focused on the weight per unit effort and percent insectivore weight. As mentioned above, no scores for these metrics can be computed without weights collected from all fish captured. Lengths were only taken on gamefish species, so it isn't possible to extrapolate approximate weights for non-gamefish species. Based on the information collected, it is doubtful that any station would have received 10 points for >25kg of fish biomass; some of the stations may have received 5 points for falling into the range of 10 to 25kg of fish biomass. All of the stations would have likely met the criteria of 11 to 60-percent of the fish biomass being classified insectivores and thus would have received 5 points for this metric; it's highly unlikely that any site would have exceeded 60-percent insectivore biomass to receive 10 points.

The second metric that was scored was the number of native species; all but one station received a score of 10 points. The only station that didn't score 10 points had 9 native species present, one short of the 10 or more native species present required to receive the full score of 10 points.

The third metric scored was the number of intolerant species present; Stations 3A and 6 received scores of 10 points, while the remaining stations only received 5 points. The lower score for the stations and low abundance of intolerant species may be somewhat misleading. Lake Superior basin streams lack many of the intolerant sucker and darter species found in other basins in the state; out of 25 species listed as intolerant in Appendix A.1 of Lyons, et al. 2001, only 6 have been documented in the Nemadji River watershed and 1 of them is a coldwater species that would not be expected to be present in the mainstem river.

The one noticeable difference between the stations receiving 10 points and those receiving 5 points was the capture of muskellunge, and in stations where muskellunge were captured, only a single individual was captured. The ability to catch muskellunge with the mini-boom relies on effectively stunning them so the dipper could capture them. In particular, adult muskellunge are able to feel the electrical field earlier than smaller fish due to their larger body size, so they are able to evade the mini-boom or are partially stunned, but still manage to swim away. During the electrofishing some larger fish splashed near the boat, but weren't readily identified, so muskellunge could have been present in the station, but not captured. Station 6 had also had spottail shiner present as a fourth intolerant species. Spottail shiners are considered a large river species rather than a riverine species and were likely migrants from the Superior Bay harbor area.

The fourth metric was the number of obligate riverine species present; three stations scored 10 points and the remaining two scored 5 points. Four or more riverine species were required to obtain a score of 10 points and the stations that received 10 points had the minimum number required, the stations that didn't receive 10 points had 2 or 3 riverine species present. As with the intolerant species, the low abundance of riverine species may be misleading because many of the darter, sucker, and minnow species commonly found in other Wisconsin drainages that fit the criteria of riverine species are not found in Lake Superior basin streams. Out of 90 species listed in Appendix A.1 of Lyons, et al. 2001, 37 are known to be present in the Nemadji River watershed and only 10 are considered riverine or large river species.

The fifth metric was the percentage of fish with deformities, erosions, lesions and/or tumors (DELT); no fish at any sites had exhibited deformities, open sores or other abnormalities. The percent of fish with signs or symptoms of DELT are often attributed to industrial or sewage discharge, however most point source pollution from industrial or municipal sources in the state of Wisconsin was eliminated or heavily treated since passage of the Clean Water Act in the 1970's. This metric was left in the scoring criteria as an extra sensitive measure to detect potential future discharge from point source polluters.

The percent obligate riverine species was the sixth metric; four of the five stations received 10 points and the remaining site, Station 3A, received 5 points. The percent riverine species in Station 3A was 29-percent, only 7-percentage points below the lower threshold of 36-percent to receive 10 points. Out of the 23 fish species captured in the surveys, only 6 were considered riverine species and the most prevalent riverine species were emerald shiner and silver redhorse. These species were present in the station and if a few more individuals were captured, this would have raised the percentage and score.

The percent simple lithophilic spawners was the last remaining metric that could be scored and four of five stations received 10 points, the remaining station received 5 points. Station 5 received 5 points, but was only 8-percentage points away from the lower threshold of 69% to receive 10 points. Capture of additional emerald or common shiners in this station would have improved the percentage and score for this metric.

Wadable Stations

The two wadable sites used were County Highway C and the 2011 survey at State Highway 35. The IBI score for County Highway C was 87 points and rated as “Excellent”; the IBI score for State Highway 35 was 70 points and was also rated as “Excellent”. Out of the 10 metrics used for scoring the fish community, both IBI scores had 5 metrics that received the highest score of 10 points. Overall, the score reflects excellent water quality, but the metrics that didn’t receive scores of 10 points may reflect some of the issues with habitat in both stations.

The first metric where both IBI scores missed points was the number of sunfish plus yellow perch. None of the wadable stream stations sampled between 2006 through 2011 (Table 3) have had more than 2 species in this metric and beyond rock bass, the only other species of sunfish captured in any of the four previous surveys was one bluegill. Downstream in the five non-wadable stations (Table 1), the only sunfish species found were rock bass and two black crappies. The moderate current and lack of deep pools in both wadable stations may be limiting preferred habitat for sunfish species other than rock bass. There was also a noticeable lack of aquatic vegetation in the both the County Highway C and State Highway 35 stations that would serve as suitable sunfish habitat.

The 2011 survey at State Highway 35 also missed points for number of intolerant species and the percent of top carnivore species. The capture of two additional intolerant fish species found in other segments of the Nemadji River would have raised the score up to 10 instead of 5. As mentioned in the discussion of the non-wadable scores and ratings, Lake Superior basin streams lack many of the intolerant sucker and darter species that are prevalent in the warmwater streams in other Wisconsin basins.

At the County Highway C station, 20-percent of the fish captured were considered tolerant of degraded habitat and were represented by creek chub and white sucker. While the station at County Highway C didn’t receive a score of 10 points, the lower score isn’t cause for alarm. The percentage tolerant species was 1-percentage point over the upper threshold of 19 to receive 10 points and three intolerant species were found in this survey.

In the 2011 survey at State Highway 35, tolerant species comprised 37-percent of the fish community and were represented mainly by creek chubs with white sucker and fathead minnows present. Five years prior to the 2011 survey, a survey of this station yielded only 13 percent of the fish community considered tolerant and 2 intolerant fish species were present. The variation in these scores may reflect migration because of the timing of the surveys; the 2011 survey took place in mid-September, while the 2006 survey was conducted in early July.

Smallmouth bass and muskellunge are two intolerant species that were present in other stations assessed on the Nemadji River, but not captured in this station. Low quality habitat may be the reason they were

not present; notes from previous surveys indicate most of the stream channel was shallow, sandy, and generally lacking cover.

The absence of smallmouth bass and muskellunge also resulted in a low top carnivore percentage of only 5 percent and a score of 0 for the State Highway 35 station. In spite of the low percentage and score, this metric was only 2 percentage points away from a score of 2 and 3 percentage points away from the lower threshold for 5 points. If rock bass and smallmouth bass were present at the same level of abundance as the 2006 survey at State Highway 35, the percentage of top carnivore score could have been better. The lower percentage top carnivore may also reflect fish migration because of the mid-September timing of the 2011 survey.

The third metric that both IBI scores didn't receive 10 points for was the percent of simple lithophil spawners (species that lay their eggs on clean gravel or cobble substrate without building a nest or providing parental care). The fish community at both County Highway C and State Highway 35 were comprised of 49-percent simple lithophil spawners and received 5 points, but were only 2 percentage points below the lower threshold of 51-percent for receiving 10 points; 50-percent would have received a score of 7 points. The vast majority of the substrate in both stations was sand or clay and the lack of suitable rock or gravel in the station limits the amount of spawning habitat for simple lithophil species and, in some cases, preferred habitat for several simple lithophil species like suckers, darters and certain minnow species. Previous surveys at other locations have typically received 5 points with the percent simple lithophil spawners ranging from 37 to 49-percent; however the station at County Highway W is an exception. This area of the Nemadji River is higher gradient and has rock and gravel riffle habitat and those features are reflected by the percent of simple lithophil species present as well as presence of species like longnose dace, hornyhead chub, stonecat and log perch that tend to live in areas with gravel and cobble habitats.

IBI Rating Summary

Despite relatively poor instream and riparian habitat in the Lower Nemadji River and some difficulty sampling fish, the fish communities documented reflect good water quality. In some instances, the lower scores for the IBI metrics reflect lower fish diversity in the Lake Superior basin rather than environmental degradation. Intolerant fish species were found in all of the stations and there was little change in species composition between the stations surveyed. Based on the information collected, the wadable stations were all scored as "Excellent". The scores for the non-wadable stations assessed this year can only be considered minimum estimates due to missing weight information for two of the metrics, however available information for each station gives ratings between "Good" and "Fair". If weight information was collected, it's likely that the non-wadable stations would have rate between "Good" and "Excellent".

5. Gamefish Resource Management Considerations

The survey work in the Lower Nemadji River watershed revealed this segment of the river supports several warmwater and coolwater gamefish species, but may be an overlooked fishery because access to the river is limited to carry-in or road-side access for anglers fishing from a canoe or similar watercraft. The Nemadji River does receive some angling pressure in the upper reaches based on observations of lures and fishing line snagged in over-hanging trees and electrical cables at bridge crossings, but most of the recreational fishing effort probably occurs within the last two to three miles; during survey work our crew encountered a pair of anglers fishing from shore at the Grand Avenue launch and two boats with fishermen trolling for walleyes and muskellunge. Future survey work could be considered to better define the gamefish resource present in the Nemadji River and what functions it might serve within the Duluth/Superior Harbor and Lake Superior.

Northern Pike and Muskellunge

Northern pike or muskellunge were found at the wadable station and 4 of 5 non-wadable stations this year as well as previous wadable stream survey work upstream from County Highway C which suggests both species are relatively common in the Nemadji River.

There are some discrepancies with the muskellunge water classification for the Nemadji River. The current version of DNR Wisconsin Muskellunge Waters lists the Nemadji River downstream from CTH C as road only access, Class A1 (lower abundance, higher trophy potential) and Category 2 (combination of natural reproduction and stocking) muskellunge water. The Surface Water Data Viewer Muskellunge Waters layer shows the Nemadji River from the WI-MN border downstream to Lake Superior is Category 0 muskellunge water (unknown reproductive status, stocking occurs). These discrepancies should be clarified to represent the muskellunge fishery present; a Class A1 designation is appropriate and Category 2 would be appropriate based on the current known reproductive status of the musky population. Future survey work could be considered to better document the muskellunge fishery present and extent of natural reproduction in the lower Nemadji River. One young-of-year muskellunge was captured in Station 6, which could indicate adult muskellunge use the floodplain marshes near the mouth of the river for spawning.

There are no state classifications or designations for northern pike waters, but the Nemadji River has the potential to produce quality size (21"+) fish and the population appears to be sustained by natural reproduction.

Muskellunge angling regulations for the Nemadji River are now consistent with the St. Louis River regulation of an open season from the Saturday nearest Memorial Day through November 30th, with a 1 fish daily bag limit and a 50-inch minimum. The current angling regulation for northern pike in the Nemadji River is an open season from the Saturday 2 weeks prior to the Saturday nearest Memorial Day through March 1st the following year, with a 26-inch minimum and 2 fish daily bag limit. These regulations are appropriate as they maintain consistency with the same opportunities for harvest that are available in the adjoining waters of the St. Louis Estuary and Lake Superior.

Walleye

Walleye were found at the wadable station and 4 out of the 5 non-wadable stations this year, as well as previous wadable stream survey work upstream from County Highway C which suggests they are also relatively common in the Nemadji River. There were multiple year classes of walleyes present in the 2015 sampling, but it is unknown if there is natural reproduction occurring in the Nemadji River or if these fish are migrants from the St. Louis River; two tagged walleyes from the spring 2015 survey work on the St. Louis River were captured in the lower Nemadji River and reported by anglers. Additional survey work could be undertaken to determine the status of the walleye fishery in the Nemadji River.

The current set of regulations for walleye, sauger, and their hybrids is an open season from the Saturday 2 weeks prior to the Saturday nearest Memorial Day to March 1st with a 15-inch minimum and a daily bag limit of 2 fish. This regulation maintains consistency with the regulations for the St. Louis River and Superior Bay as well as the same length limit for Lake Superior and Lake Superior tributaries and sloughs; Lake Superior and the tributary streams and sloughs have different season structure and a daily bag limit of 5 walleyes, but only 1 fish over 20-inches is allowed.

Smallmouth and Largemouth Bass

Smallmouth bass are also very prevalent in the Lower Nemadji River, every site sampled this year had smallmouth bass present, however most individuals captured were young-of-year and juvenile fish less than 12-inches. The Lower Nemadji River could be added to the current state list of smallmouth bass waters as a non-wadable fine substrate smallmouth bass stream. This designation does not afford any additional environmental protection to the river, but serves to confirm the presence of smallmouth bass in the river and this segment of the river would appear in Smallmouth Bass Stream layer in the Surface Water Data Viewer that is accessible to department staff and the public.

Largemouth bass abundance in the Nemadji River appears to be very low; only one largemouth bass was captured in Station 6, near the confluence with Superior Bay.

There is no catch and release season for bass applied to the Nemadji River, the current set of regulations for smallmouth and largemouth bass is an open (harvest) season from the last Saturday in May through March 1st the following year, with a five fish daily bag limit and a minimum length limit of 12-inches. The length limit on bass could be increased to 14-inches for the sake of consistency with the length limit on the St. Louis River and Superior Bay.

Other notable species

Based on the electrofishing catch, panfish species occurred in relatively low abundance at all of the stations sampled this year. Rock bass and yellow perch were the most prevalent of the panfish species documented, but few of the individuals captured were large enough to be of interest to anglers.

One channel catfish was captured, no other catfish were observed or collected, but electrofishing with the mini-boom shocker is not the most efficient means of capturing catfish or other benthic species. If there is management interest in channel catfish in the St. Louis River estuary, a survey including the lower Nemadji River could be considered and hoop or trap nets or hook-and-line gear like a trot line or set line could be a more efficient means of capturing catfish.

Lake sturgeon are present in the St. Louis River and estuary, but sturgeon were not observed or collected during this survey work, so there remains no information to suggest sturgeon use any portion of the Nemadji River.

6. Literature and Data Cited

John Lyons, Randal R. Piette & Kent W. Niermeyer (2001) Development, Validation, and Application of a Fish-Based Index of Biotic Integrity for Wisconsin's Large Warmwater Rivers, Transactions of the American Fisheries Society, 130:6, 1077-1094

Lyons, John 1992. Using the index of biotic integrity (IBI) to measure environmental quality in warmwater streams of Wisconsin. General Technical Report NC-149. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station

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NON-WADABLE RIVER FISH COMMUNITY SUMMARY

STREAM: Nemadji River	STATION:	DISTANCE SHOCKED (miles):	RIVER MILE AT STATION START:
WBIC: 2835300	3	1.08	14
COUNTY: Douglas	3A	1.30	12
GEAR: 240V 3000W DCP Mini-Boom	4	1.10	10
16 Droppers, 1 Dipper	5	1.22	3
	6	1.44	1

TAXONOMIC FAMILY FISH SPECIES	Origin /					Spawning Type	STATION NUMBERS					Total
	Thermal Guild	Tolerance	Feeding	Habitat			3	3A	4	5	6	Captured
<i>Esocidae</i>											8	
MUSKELLUNGE	NCL	I	TC	O	O		1			1	2	
NORTHERN PIKE	NEU	M	TC	O	O	1	1		4		6	
<i>Percidae</i>											39	
WALLEYE	NEU	M	TC	O	SL	1		2	1	6	10	
YELLOW PERCH	NEU	M	IN	O	O	1	4	1	5	6	17	
JOHNNY DARTER	NEU	M	IN	O	O		2				2	
LOG PERCH	NEU	M	IN	O	SL	6	4				10	
<i>Centrarchidae</i>											35	
SM BASS	NEU	I	TC	O	O	3	9	1	1	3	17	
LM BASS	NEU	M	TC	O	O					1	1	
BLACK CRAPPIE	NEU	M	TC	O	O					2	2	
ROCK BASS	NEU	I	TC	O	O	1	7	2	4	2	16	
<i>Cyprinidae</i>											225	
EMERALD SHINER	NEU	M	IN	L	SL	51	12	12	1	32	108	
COMMON SHINER	NEU	M	IN	O	SL	15	30	8	5	1	59	
SAND SHINER	NEU	M	IN	R	O	3	8		10	29	50	
SPOTTAIL SHINER	NEU	I	IN	L	O					6	6	
BLUNTNOSE MINNOW	NEU	T	OM	O	O				1		1	
HORNHEAD CHUB	NEU	M	IN	R	O		1				1	
<i>Ictaluridae</i>											1	
CHANNEL CATFISH	NEU	M	TC	O	O			1			1	
<i>Catostomidae</i>											45	
WHITE SUCKER	NEU	T	OM	O	SL	6					6	
SILVER REDHORSE	NEU	M	IN	R	SL	5	3	4	7	6	25	
SHORHEAD REDHORSE	NEU	M	IN	O	SL	7	1	1	1	4	14	
<i>Moronidae</i>											6	
WHITE PERCH	EEU	M	TC	O	O				2	4	6	
<i>Percopsidae</i>											1	
TROUT-PERCH	NEU	M	IN	O	O	1					1	
<i>Scianidae</i>											1	
FRESHWATER DRUM*	EEU	M	IN	L	O	1					1	
*Native to WI, but not Lake Superior Basin												
Station Total						102	83	32	42	103		

COMMENTS:

Origin / Thermal Guild - N - Native, E - Exotic / EU - Eurythermic, CL - Stenothermal Coolwater, CD - Stenothermal Coldwater

Tolerance - I-Intolerant, M-Moderately Intolerant, T-Tolerant

Feeding - FI-Filter Feeder, Ge-Genral Feeder, He-Herbivore, Pa-Parasitic, O-Omnivore, I-Insectivore, TC-Top Carnivore,

Habitat - L-Large River, R-Riverine, O-Other, Spawning Habitat - SL-Simple Lithophilous, O-Other

Table 1. Catch-per-effort summary and species characteristics for all non-wadable stations surveyed on Nemadji River in 2015.

NON-WADABLE RIVER FISH COMMUNITY SUMMARY

	STATION:	DISTANCE SHOCKED (miles):	RIVER MILE AT STATION START:
STREAM: Nemadji River	3	1.08	14
WBIC: 2835300	3A	1.30	12
COUNTY: Douglas	4	1.10	10
GEAR: 240V 3500W DCP Mini-Boom	5	1.22	3
16 Droppers, 1 Dipper	6	1.44	1

Station Name	3	3A	4	5	6
Survey Year	2015	2015	2015	2015	2015
Survey Date	8/3/15	8/4/15	8/3/15	8/5/15	8/5/15
Primary Survey Purpose	Fish Community Survey	Fish Community Survey	Fish Community Survey	Fish Community Survey	Fish Community Survey
Total Fish Collected:	102	83	32	40	98
WPUE (kg):	Minnows, suckers, and darters were counted but not weighed				
WPUE (kg) Score:	Unable to compute scores without aggregate weights				
Number Native Species:	14	13	9	11	13
Number Native Species Score:	10	10	5	10	10
Number Intolerant Species:	2	3	2	2	4
Number Intolerant Species Score:	5	10	5	5	10
Riverine Species:	4	4	2	3	4
Riverine Species Score:	10	10	5	5	10
% DELT (Deformity, Erosion, Lesion, Tumor):	0	0	0	0	0
% DELT (Deformity, Erosion, Lesion, Tumor) Score:	10	10	10	10	10
% Riverine Species (n):	59%	29%	50%	42%	74%
% Riverine Species Score	10	5	10	10	10
% Lithophils (n):	92%	70%	84%	61%	79%
% Lithophils (n) Score:	10	10	10	5	10
%Insectivore (wt):	Minnows, suckers, and darters were counted but not weighed				
%Insectivore (wt) Score:	Unable to compute scores without aggregate weights				
Score Subtotal	55	55	45	45	60
Correction Factor For Lower Sucker Richness in Lake Superior Basin Streams (Subtotal X 1.25)	1.25	1.25	1.25	1.25	1.25
Non-Wadable River Warmwater IBI Score	≥68.75	≥68.75	≥56.25	≥56.25	≥75
Non-Wadable River Warmwater IBI Integrity Rating	Good	Good	Fair	Fair	Good

Table 2. IBI scores and ratings for all non-wadable stations surveyed on Nemadji River in 2015. Ratings and scores for all of the stations are not complete due to missing weight information and should be considered minimum estimates.

WADABLE RIVER FISH COMMUNITY SUMMARY

STREAM: Nemadji River	YEAR:	STATION:	DISTANCE SHOCKED (meters):	RIVER MILE AT STATION START:
WBIC: 2835300	2006	STH 35	645	18.4
COUNTY: Douglas	2008	Finn Rd	425	20
GEAR: 240V Tow Barge	2009	CTH W	440	31.2
	2011	STH 35	855	18.4
	2015	CTH C	400	11.75

<u>TAXONOMIC FAMILY</u>	Origin / Thermal Guild Tolerance Feeding				STATION NUMBERS / SURVEY YEAR				
FISH SPECIES	Thermal Guild	Tolerance	Feeding	Spawning Type	STH 35 2006	Finn Rd 2008	CTH W 2009	STH 35 2011	CTH C 2015
<u>Esocidae</u>									
MUSKELLUNGE	NCL	I	TC	O			1		1
NORTHERN PIKE	NEU	M	TC	O				2	
<u>Percidae</u>									
WALLEYE	NEU	M	TC	SL	1	1	3	1	1
YELLOW PERCH	NEU	M	IN	O					2
JOHNNY DARTER	NEU	M	IN	O	2	1	11	3	6
LOG PERCH	NEU	M	IN	SL	3	1	70	8	1
<u>Centrarchidae</u>									
SM BASS	NEU	I	TC	O	4	2	3		6
ROCK BASS	NEU	I	TC	O	39	29	25	16	12
BLUEGILL	NEU	M	IN	O				1	
<u>Cyprinidae</u>									
EMERALD SHINER	NEU	M	IN	SL					4
COMMON SHINER	NEU	M	IN	SL	53	29	54	150	36
SAND SHINER	NEU	M	IN	O		11	1	4	1
HORNHEAD CHUB	NEU	M	IN	O	27	22	78	8	7
LONGNOSE DACE	NEU	M	IN	SL			38		
CREEK CHUB	NEU	T	GE	O	23	4	3	78	21
FATHEAD MINNOW	NEU	T	O	O				14	
BRASSY MINNOW	NCL	M	HE	O	3				
<u>Ictaluridae</u>									
STONECAT	NEU	M	IN	O	5	2	7	2	
<u>Catostomidae</u>									
WHITE SUCKER	NEU	T	O	SL		2	18	8	1
SILVER REDHORSE	NEU	M	IN	SL	2	6	38	2	
SHORTHEAD REDHORSE	NEU	M	IN	SL	22	7		5	13
<u>Percopsidae</u>									
TROUT-PERCH	NEU	M	IN	O		7	4	22	1
<u>Umbridae</u>									
CENTRAL MUDMINNOW	NEU	M	IN	O				12	1
<u>Petromyzonidae</u>									
LAMPREYS	UNKNOWN	I	FI / PA	O		1			
No indication of life stage or species - can't assign origin, thermal guild or feeding									
Station Total					184	125	354	336	114
COMMENTS:									
Origin / Thermal Guild - N - Native, E - Exotic / EU - Eurythermic, CL - Stenothermal Coolwater, CD - Stenothermal Coldwater									
Tolerance - I-Intolerant, M-Moderately Intolerant, T-Tolerant									
Feeding - FI-Filter Feeder, Ge-Genral Feeder, He-Herbivore, Pa-Parasitic, O-Omnivore, I-Insectivore, TC-Top Carnivore,									
Spawning Habitat - SL-Simple Lithophilous, O-Other									

Table 3. Catch-per-effort summary and species characteristics for all wadable stations surveyed on Nemadji River.

WADABLE RIVER FISH COMMUNITY SUMMARY

STREAM: Nemadji River	YEAR:	STATION:	DISTANCE SHOCKED (meters):	RIVER MILE AT STATION START:
WBIC: 2835300	2006	STH 35	645	18.4
COUNTY: Douglas	2008	Finn Rd	425	20
GEAR: 240V Tow Barge	2009	CTH W	440	31.2
	2011	STH 35	855	18.4
	2015	CTH C	400	11.75

Station Name	STH 35	Finn Rd	CTH W	STH 35	CTH C
Survey Year	2006	2008	2009	2011	2015
Survey Begin Date	7/7/06	7/29/08	8/19/09	9/15/11	8/4/15
Survey End Date	7/7/06	7/31/08	9/11/09	9/15/11	8/4/15
Primary Survey Purpose	WATERSHED CLEAN WATER ACT	NATURAL COMMUNITY REFERENCE	SPECIAL STUDY	NATURAL COMMUNITY REFERENCE	FISH COMMUNITY SURVEY
Mean Stream Width (meters)	18.4	13.8	17.5	24.4	19
Total Fish Count Sum	184	124	354	355	114
Number Native Species	12	14	15	18	16
Number of Native Species Score Lake Superior	5	5	10	10	10
Number Darter Madtom Sculpin Species	2	2	2	2	2
Number Darter Madtom Sculpin Species Lake Superior Score	10	10	10	10	10
Number Sucker Species	2	3	2	3	2
Number Sucker Species Score Lake Superior	10	10	10	10	10
Number Sunfish Yellow Perch Species	1	1	1	2	2
Number Sunfish Yellow Perch Species Score Lake Superior	5	5	5	5	5
Number Intolerant Species	2	2	3	1	3
Number Intolerant Species Score Lake Superior	5	5	10	5	10
Percent Tolerant	13	5	6	37	20
Percent Tolerant Score	10	10	10	5	7
Percent Omnivore	0	2	5	6	1
Percent Omnivore Score	10	10	10	10	10
Percent Insectivores	62	69	85	66	63
Percent Insectivore Score	10	10	10	10	10
Percent Top Carnivore	24	26	9	5	18
Percent Top Carnivore Score	10	10	5	0	10
Percent Simple Lithophile	44	37	62	49	49
Percent Simple Lithophile Score	5	5	10	5	5
Abundance Correction Factor	75	83	227	79	68
Percent DELT	-	-	-	-	-
Warmwater IBI Score Lake Superior	80	80	90	70	87
Warmwater IBI Score Lake Superior Corrected	80	80	90	70	87
Warmwater IBI Integrity Rating Lake Superior	Excellent	Excellent	Excellent	Excellent	Excellent

Table 4. IBI scores and ratings for all wadable stations surveyed on Nemadji River.

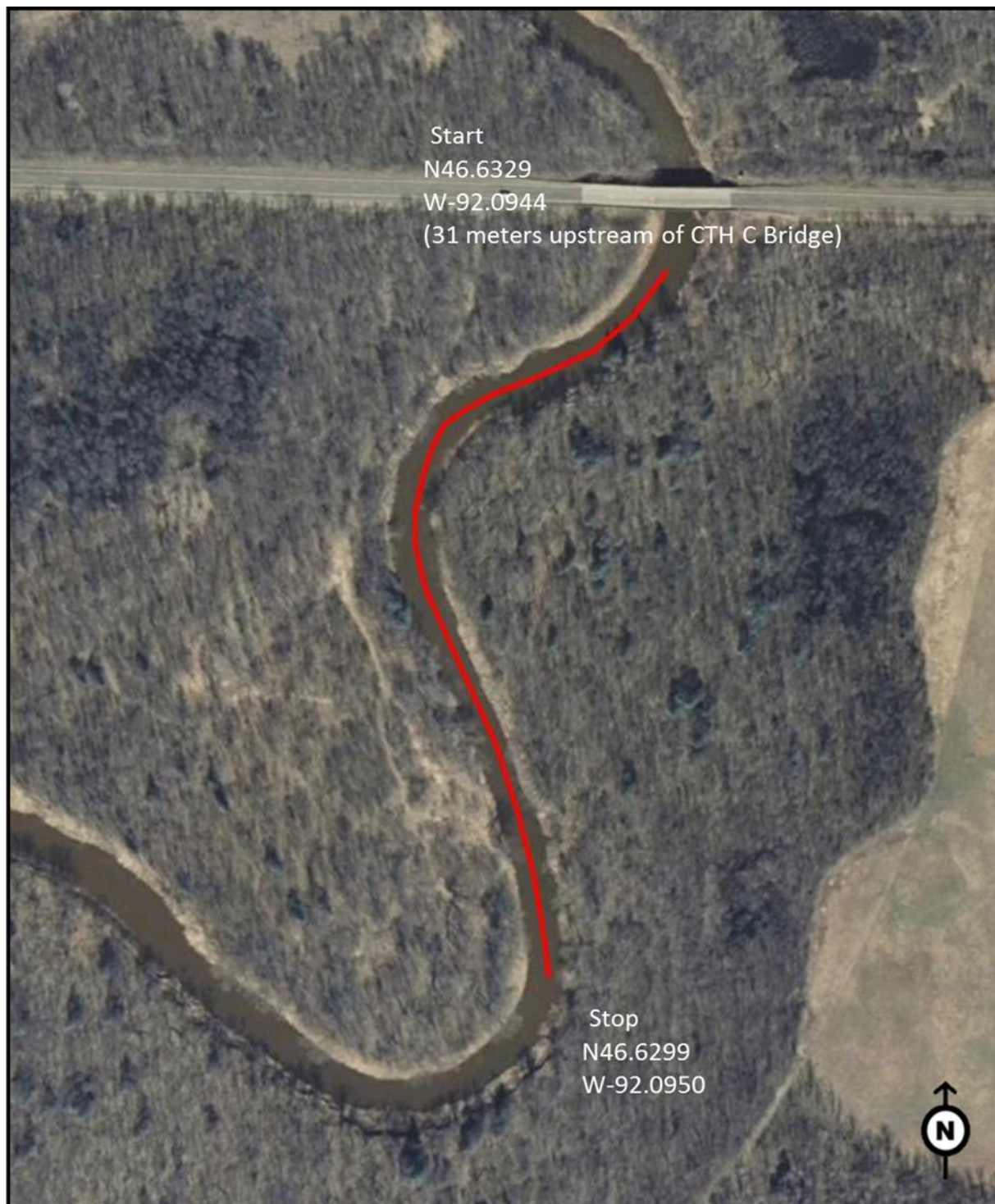
Appendix I.
Electrofishing Station Maps



Nemadji River, Douglas County
Electrofishing Stations
2015 Fish Community Survey



Figure 1. Map of electrofishing stations assessed during 2015 fish community sampling on Nemadji River, Douglas County, WI.



Nemadji River, Douglas County

Wadable River Electrofishing
Fish Community Survey
Station 2

Legend

— Station (400 meters)





Nemadji River, Douglas County

Non-Wadable River Electrofishing

Fish Community Survey

Station 3

Legend

— Station (1.08 miles)





Legend

— Station (1.30 miles)

Nemadji River, Douglas County

Non-Wadable River Electrofishing

Fish Community Survey

Station 3A





Legend

— Station (1.10 miles)

Nemadji River, Douglas County
Non-Wadable River Electrofishing
Fish Community Survey
Station 4





Legend

— Station (1.22 miles)

Nemadji River, Douglas County
Non-Wadable River Electrofishing
Fish Community Survey
Station 5





Nemadji River, Douglas County

Non-Wadable River Electrofishing

Fish Community Survey

Station 6

Legend

— Station (1.44 miles)

